CLAIMS

What is claimed is:

1. A method for monitoring a superconducting magnet system, comprising:

determining a magnet system type and associated sensor types of the superconducting magnet system;

selecting magnet settings for a monitoring system that monitors the superconducting magnet system, such settings generally corresponding to the determined magnet type and determined sensor types, and including one or more scaling factors for analog-to-digital conversion; and

programming the monitoring system in accordance with the selected magnet settings.

2. The method of claim 1, comprising:

providing an analog signal from a sensor disposed in the superconducting magnet system, such analog signal indicative of a property of the superconducting magnet system; and

scaling an analog-to-digital conversion of the analog signal based on the one or more scaling factors.

3. The method of claim 2, further comprising scaling an excitation current for input to the sensor, and wherein the scaling of the excitation current is based on the magnet settings.

4. The method of claim 2, wherein the superconducting magnet system provides one or more magnetic fields in a magnetic resonance (MR) imaging system; and the monitoring system monitors at least one of a cryogen level, a cryogen pressure, a cryogen temperature, a cryogen shield temperature, a magnet current, a magnet field strength and corresponding frequency, a heater duty cycle, and a cold head temperature.

5. The method of claim 2, wherein the sensor is a resistance temperature detector (RTD) and the scaling factors comprise a selectable voltage setting and Callendar-Van Dusen coefficients.

6. The method of claim 2, further comprising comparing a value of the indicated property with a set point and indicating an alarm condition.

7. The method of claim 6, indicating an alarm condition comprises at least one of a local audible alarm, a local light, a remote alarm at an on-line service center, an e-mail message, and a pager message.

8. The method of claim 6, further comprising servicing or resetting the superconducting magnet system.

9. The method of claim 6, further comprising outputting a voltage control signal.

10. A method for monitoring a superconducting magnet system, comprising:

selecting a magnet profile that corresponds to a magnet system type and associated sensor types of the superconducting magnet system;

configuring a monitoring system that monitors the superconducting magnet system based on the selected profile, such profile including one or more scaling factors for analog-to-digital conversion;

providing an analog signal from a sensor disposed in the superconducting magnet system, such analog signal representative of an operating variable of the superconducting magnet system; and

scaling an analog-to-digital conversion of the analog signal based on the one or more scaling factors.

11. The method of claim 10, further comprising scaling an excitation current for input to the sensor, and wherein the scaling of the excitation current is determined by the magnet profile.

12. The method of claim 10, wherein the configuration of the monitoring system is performed automatically based upon the selected profile.

13. The method of claim 10, further comprising providing an output signal from the system to reduce helium boil-off, helium loss, MRI downtime, or MRI maintenance costs.

14. The method of claim 10, wherein the superconducting magnet system provides one or more magnetic fields in a magnetic resonance (MR) imaging system; and the operating variable of the superconducting magnet system is at least one of a cryogen level, a cryogen pressure, a cryogen temperature, a cryogen shield temperature, a magnet current, a magnet field strength and corresponding frequency, a heater duty cycle, a cold head temperature, and a compressor pressure.

15. The method of claim 10, further comprising comparing a value of the operating variable with a set point and indicating an alarm condition, such indication comprising at least one of a local audible alarm, a local light, a remote alarm at an on-line service center, an e-mail message, and a pager message.

16. The method of claim 15, further comprising servicing the superconducting magnet system or outputting a voltage control signal.

17. The method of claim 10, further comprising scaling conversion of a digital signal to an analog signal, such digital signal received from a second sensor disposed in the superconducting magnet.

18. A monitoring system for remotely monitoring a superconducting magnet system, comprising:

a scalable analog-to-digital converter that measures an analog signal from a sensor disposed in the superconducting magnet system;

a magnet selector interface for scaling the analog-to-digital converter and other monitoring system components to correspond to the particular sensor and to the type of superconducting magnet system being monitored;

control and monitoring circuitry for processing a digital signal converted from the analog signal; and

a communications module for sending signals to a remote host system and receiving signals from the remote host system.

19. The system of claim 18, further comprising scalable excitation circuitry that provides excitation current to the sensor, and wherein the excitation current is scaled to correspond to the particular sensor and the type of superconducting magnet system being monitored.

20. The system of claim 19, further comprising an integrated power supply for supplying excitation current to the sensor by supplying power to the excitation circuitry.

21. The system of claim 20, wherein the monitoring system comprises a remote terminal unit.

22. The system of claim 18, wherein the remote host system is an on-line service center.

23. A monitoring system for monitoring a superconducting magnet system, comprising:

a scalable analog digital converter with integrated excitation circuitry that provides an excitation current to a sensor disposed in the superconducting magnet system and that reads an analog signal from the sensor;

a magnet selector interface for scaling the analog-to-digital converter and integrated excitation circuitry based on the particular sensor and on the particular superconducting magnet system being monitored;

control and monitoring circuitry and a communications module for processing and sending data to a remote host system and for receiving and processing data from the remote host system; and

a power supply for supplying power to analog-to-digital converter and the integrated excitation circuitry.

24. The system of claim 23, wherein the remote host system is an on-line service center.

25. The system of claim 23, wherein the superconducting magnet system uses recondensing technology and is disposed in an MR imaging system.

26. A superconducting magnet system, comprising:

a cryogen vessel disposed in the superconducting magnet system and holding a cryogen for cooling one or more magnets;

a scalable analog-to-digital converter with integrated excitation circuitry that provides an excitation current to a sensor disposed in the superconducting magnet system and that reads an analog signal from the sensor;

a magnet selector interface for scaling the analog-to-digital converter and integrated excitation circuitry based on the particular sensor and on the particular superconducting magnet system being monitored;

control and monitoring circuitry and a communications module for processing and sending data to a remote host system and for receiving and processing data from the remote host system; and

a power supply for supplying power to analog-to-digital converter and the integrated excitation circuitry.

27. The system of claim 26, comprising:

a cold head configured for removing heat from the superconducting magnet and condensing cryogen vapor received from a vapor space of the cryogen vessel;

a refrigerant compressor system that supplies refrigerant to the cold head to cool the cold head;

a heater for vaporizing cryogen liquid and controlling pressure in the cryogen vessel; and

a relief vent disposed in the superconducting magnet system for relieving cryogen from the cryogen vessel;

28. The system of claim 27, wherein the superconducting magnet system is disposed within a magnetic resonance (MR) imaging system.

29. The system of claim 26, wherein the cryogen comprises helium.

30. The system of claim 29, wherein the pressure of the cryogen vessel is controlled in the approximate range of 4.0 to 4.5 psig and the temperature of the magnets is controlled at approximately 4 Kelvin.

31. A system for monitoring a recondensing superconducting magnet, comprising:

means for determining a magnet system type and associated sensor types of the superconducting magnet system;

means for selecting magnet settings for the monitoring system, such settings generally corresponding to the determined magnet type and determined sensor types, and including one or more scaling factors for analog-to-digital conversion; and

means for programming the monitoring system in accordance with the selected magnet settings.

32. The system of claim 31, comprising:

means for providing an analog signal from a sensor disposed in the superconducting magnet system, such analog signal indicative of a property of the superconducting magnet system; and

means for scaling an analog-to-digital conversion of the analog signal based on the one or more scaling factors.

33. The system of claim 32, further comprising means for scaling an excitation current for input to the sensor based on the magnet settings.

34. The system of claim 32, further comprising means for comparing a value of the indicated property with a set point and indicating an alarm condition.

35. The system of claim 32, further comprising means for servicing or resetting the superconducting magnet system.

36. The system of claim 32, further comprising means for outputting a voltage control signal.

37. A superconducting magnet system, comprising:

means for selecting a magnet profile that corresponds to a magnet system type and associated sensor types of the superconducting magnet system;

means for configuring a monitoring system based on the selected profile, such profile including one or more scaling factors for analog-to-digital conversion;

means for providing an analog signal from a sensor disposed in the superconducting magnet system, such analog signal representative of an operating variable of the superconducting magnet system;

means for scaling an analog-to-digital conversion of the analog signal based on the one or more scaling factors; and

means for communicating a value of the operating variable to a remote host system.

38. The system of claim 37, further comprising means for scaling an excitation current for input to the sensor, and wherein the scaling of the excitation current is determined by the magnet profile.

39. The system of claim 37, wherein the superconducting magnet system provides one or more magnetic fields in a magnetic resonance (MR) imaging system;

40. A computer program, provided on one or more tangible media, for operating a superconducting magnet system, comprising:

a routine for determining a magnet system type and associated sensor types of the superconducting magnet system;

a routine for selecting magnet settings for the monitoring system, such settings generally corresponding to the determined magnet type and determined sensor types, and including one or more scaling factors for analog-to-digital conversion;

a routine for programming the monitoring system in accordance with the selected magnet settings; and

a routine for remotely monitoring the superconducting magnet system.

41. The computer program of claim 40, comprising:

a routine for providing an analog signal from a sensor disposed in the superconducting magnet system, such analog signal indicative of a property of the superconducting magnet system; and

a routine for scaling an analog-to-digital conversion of the analog signal based on the one or more scaling factors.

42. The computer program of claim 41 further comprising a routine for scaling an excitation current for input to the sensor based on the magnet settings.

43. The computer program of claim 41, further comprising a routine for comparing a value of the indicated property with a set point and indicating an alarm condition.

44. The computer program of claim 43, further comprising a routine for outputting a voltage control signal.

45. A computer program, provided on one or more tangible media, for monitoring a superconducting magnet system, comprising:

a routine for selecting a magnet profile that corresponds to a magnet system type and associated sensor types of the superconducting magnet system;

a routine for configuring a monitoring system that monitors the superconducting magnet system based on the selected profile, such profile including one or more scaling factors for analog-to-digital conversion;

a routine for providing an analog signal from a sensor disposed in the superconducting magnet system, such analog signal representative of an operating variable of the superconducting magnet system;

a routine for scaling an analog-to-digital conversion of the analog signal based on the one or more scaling factors; and

a routine for scaling an excitation current for input to the sensor, and wherein the scaling of the excitation current is determined by the magnet profile.

46. The computer program of claim 45, further comprising:

a routine for comparing a value of the operating variable with a set point; and

a routine for indicating an alarm condition, such indication comprising at least one of a local audible alarm, a local light, a remote alarm at an on-line service center, an e-mail message, and a pager message.

47. The computer program of claim 46, further comprising a routine for outputting a voltage control signal.